APPENDIX K
DRAFT PRELIMINARY WATER CONTROL PLAN FOR THE TEN MILE CREEK DEEP WATER STORAGE AREA

Four permanent structures will be constructed as part of the Ten Mile Creek Deep Water Storage Area (DWSA). These structures consist of two pump stations, S-382 and S383; a culvert, S-384; and an emergency spillway. The main pump station, S-382, will pump water from Ten Mile Creek into the DWSA. The S-383 pump station will deliver water into the treatment cell by the use of gravity flow or a small pump. The S-384 culvert will be used for treatment cell outfall. The emergency spillway will be located near the main pump station, and is intended to relieve the DWSA in the event of severe storms. This draft plan describes the proposed operating criteria for these structures.

The Ten Mile Creek DWSA is part of the Ten Mile Creek Critical Project, which is ranked as the eleventh most important project of the 34 proposed critical projects. This project is located in St. Lucie County, southwest of Fort Pierce. It is situated just south of State Road 70 (Okeechobee Road) and west of the intersection of I-95 and the Florida Turnpike and north of Midway Road. The project is located at the outlet of the 30,682-acre (48-square mile) Ten Mile Creek basin.

GENERAL OBJECTIVES

This preliminary water control plan focuses on how the project will operate during the operational testing and monitoring phase of the project. This plan includes the flexibility to make incremental changes to the proposed optimum canal elevations, the DWSA, and the treatment cells throughout the testing period in order to achieve desired project benefits while maintaining the existing level of flood protection in the Ten Mile Creek basin.

The Ten-Mile Creek Reservoir/Stormwater Treatment Area (referred to from this point on as the treatment cell) will restore two degraded features of the North Fork St. Lucie River basin: water storage and nutrient demand. Restoring these features will result in a more natural pattern of freshwater flows into the estuary, more natural (lower) volumes of runoff leaving the basin, and reduced nutrient loads leaving the basin.

The Ten Mile Creek DWSA will provide additional water storage to the basin. Rapid pumping to and slow drainage from the reservoir mimics the behavior of shallow surface storage that has been lost through development over the years. When operated correctly, the reservoir reduces runoff from most storm events and helps restore the historic flow pattern of fresh water entering the estuary. Water stored in the reservoir will also reduce total runoff leaving the basin and simultaneously reduce demands on the Floridan aquifer. The reservoir and the adjoining treatment marsh will improve

downstream water quality by filtering runoff and removing suspended sediments, phosphorous, and nitrogen.

The operations of the DWSA facilities are expected to maximize prestorm available storage, maximize dry season water supply, and maximize treatment of basin runoff. These are competing objectives that must be balanced through the operating rules. Achieving an optimal balance will require adjustments in the operating rules to incorporate improvements in the understanding of watershed hydrology, local water management, and regional water management. Current hydrologic analyses indicate the optimal balance occurs when pumps try to capture 50 percent of storm runoff (minus base flow) and when dry-season releases to the filter marsh decrease with decreasing storage.

This preliminary water control plan focuses on how the project will operate during the operational testing and monitoring phase of the project. This plan includes the flexibility to make incremental changes to the proposed optimum canal elevations, the DWSA, and the treatment cells throughout the testing period in order to achieve desired project benefits while maintaining the existing level of flood protection in the Ten Mile Creek basin.

FEATURES

This project consists of a DWSA storage area and an adjacent treatment cell. The DWSA will have 500 acres of effective storage area and the treatment cell will have roughly 160 acres of treatment area. The DWSA and the treatment cell will have a total storage capacity of approximately 6,000 acre-feet.

Water will inflow into the DWSA system via the S-382 pump station that is located on the northern levee adjacent to the creek. S-382 will have a total pumping capacity of 380-cubic feet per second (cfs). It will have three pumps. One will have a pumping capacity of 60 cfs and two will each have a pumping capacity of 160 cfs. In addition, the pump station will have a return bay with a 100-cfs capacity for flows from the DWSA back to the creek. An overflow weir set at an elevation of 29.75 feet National Geodetic Vertical Datum of 1929 (NGVD) will also be included on the northern side of the project adjacent to the creek for emergency flows.

The outflow structure, for the DWSA, the S-383 pump station, will consist of a 40-cfs control structure that will usually pass water by gravity from the DWSA to the treatment cell. When the DWSA drops below the bottom elevation of the treatment cell (17.0 feet NGVD), the gravity control structure will not be able to transfer flows. Two pumps have been included to ensure that water can flow out of the structure when it falls below this elevation. The two small pumps will have pumping capacities of 15 and 25 cfs.

The outflow structure for the treatment cell, the S-384 culvert, will consist of a 100-cfs gravity controlled structure that will flow into Canal 96 of the North St. Lucie River Water Control District. From this point, the water will flow north in Canal 96 and

discharge downstream of the existing Gordy Road control structure on the eastern end of Ten Mile Creek. This control structure is owned and operated by the NSLRWCD.

The Gordy Road control structure, known as S-71-1 by NSLRWCD, is the easternmost water control structure. It is a 4-bay radial gate spillway. The outside gates are two 18-foot wide radial gates, with a crest elevation of 9.3 feet NGVD and inverts of the gates are at an elevation of 3.0 feet NGVD. The inside gates are two 18-foot wide radial gates, with a crest elevation of 10.0 feet NGVD and inverts of the gates are also at an elevation of 3.0 feet NGVD. This structure is generally operated to maintain an upstream pool elevation of 9.5 to 10.5 feet NGVD. Additional operating details for this structure and other pertinent structures operated by NSLRWCD can be found by contacting the NSLRWCD office at (561)-461-5050.

The Ten Mile Creek Project must maintain the current level of flood protection in the Ten Mile Creek drainage basin. Also, it should not impact the normal operations of the NSLRWCD.

OVERALL PLAN FOR WATER CONTROL

The development of the operational plan being proposed was dependent on the determination of optimum water elevations in the canals, the DWSA, and the treatment cells. To determine the optimum elevation, a preliminary analysis of daily stage data at the Gordy Road control structure was done. The investigation revealed that water levels upstream of the Gordy Road structure are typically maintained between 9.5 and 10.5 feet NGVD.

Guidelines for S-382 and S-383

The operating criteria for the pump stations are based on water elevations. The elevations were determined by using discharge rating curves that calculated discharges. The rating curves were developed by applying field measurements taken by the South Florida Water Management District (SFWMD) to a theoretical "over the top flow" equation. The field measurements were used to calibrate the coefficient of discharge, C_d, in **Equation (K-1)**.

$$Q = C_d L \sqrt{2 g H_g^{\,3}} \qquad \text{(K-1)}$$

NEED TO DEFINE PARAMETERS IN THE EQUATION

S-382

The discharge rating curve used to calculate discharges at the Gordy Road control structure **Table K-1**. The rating curve is developed only for water that would be discharged without any gate openings by the NSLRWCD.

Table K-1. Discharge Rating Curve for the S-382 Pump Station

Elevation at Gordy Road Structure (feet NGVD)	Discharge (Q) (cfs)
9	0.00
9.1	0.00
9.2	0.00
9.3	0.78
9.4	5.88
9.5	13.50
9.6	22.97
9.7	33.98
9.8	46.35
9.9	59.94
10	76.24
10.1	95.28
10.2	117.94
10.3	144.05
10.4	172.79
10.5	203.83
10.6	236.96
10.7	272.04
10.8	308.94
10.9	347.56
11	387.82

The base flow runoff for the Gordy Road control structure is 15 cfs. Since capturing the base flow is not an objective of this project, the turn on criteria for flows that exceed base flow conditions should be a headwater stage that will allow 15 cfs of water per day to pass over the Gordy Road structure, while capturing 50 percent of the water that exceeds the base flow and storing it in the DWSA. To ensure a smoother transition when capturing this excess flow, pump 1 should only be turned on part of the day.

Based on the discharge rating curve, at a headwater elevation of 9.7 feet NGVD, approximately 34 to 35 cfs of water will pass over the Gordy Road structure. If pump 1, with a pumping capacity of 60 cfs, is running 8 hours per day, it would be delivering discharges equivalent to 20 cfs per day into the DWSA and the equivalent of 15 cfs per day would continue to pass over the Gordy Road structure. Therefore, pump 1 should only

be turned on 8 hours each day when the elevation of water is between 9.7 and 10.1 feet NGVD.

The NSLRWCD will maintain its normal operations during runoff events, which means that the Gordy Road structure will begin pumping if the headwater reaches 11.0 feet NGVD. Therefore, S-382 should be operating at full capacity when the canal reaches 10.8 feet NGVD. The S-382 pumping station capacity will be 380 cfs. If the DWSA reaches the maximum storage capacity of 29.75 feet NGVD, then pumping at S-382 should stop.

S-382 Turn On Criteria

The S-382 turn on criteria during a runoff event are as follows:

1. If the water level increases to an elevation of 10.1 feet NGVD, pump 1 should be turned on.
2. If the water level increases to an elevation of 10.6 feet NGVD, pump 2 should be turned on.
3. If the water level increases to an elevation of 10.8 feet NGVD, pump 3 should be turned on.

S-382 Turn Off Criteria

The S-382 turn off criteria as water levels recede are as follows:

1. If the water level recedes to an elevation of 10.7 feet NGVD, pump 3 should be turned off.
2. If the water level recedes to an elevation of 10.3 feet NGVD, pump 2 should be turned off.
3. If the water level recedes to an elevation of 9.7 feet NGVD, pump 1 should be turned off.

Cooperation with the NSLRWCD

By operating the pump station using this criteria, the pumps will be at full capacity before NSLRWCD begins operating the Gordy Road structure. The elevation at which the structure will begin operating is approximately 11 feet NGVD.

The NSLRWCD office may request water from the DWSA be returned to the Ten Mile Creek Canal for agricultural use. If the headwater water level at the S-382 pump station is below 9.0 feet NGVD, then the discharge culvert at S-382 should be opened to refill the canal until it reaches the optimum level of 9.5 feet NGVD. This is subject to the availability of water. Although not being a project purpose, this action might temporarily help satisfy agricultural demands, especially in the dry season, while maintaining the integrity of the project.

The NSLRWCD has agreed that existing operating conditions at the Gordy Road Water Control Structure will remain unchanged. Changes should not be required, since the operation described above will actually reduce the number of gate changes needed at the Gordy Road structure.

The NSLRWCD will maintain its normal operations during runoff events, which means that the Gordy Road structure will begin pumping if the headwater reaches 11.0 feet NGVD. Therefore, S-382 should be operating at full capacity when the canal reaches 10.8 feet NGVD.

The S-382 pumping station capacity will be 380 cfs. If the DWSA reaches the maximum storage capacity of 29.75 feet NGVD, then pumping at S-382 should stop.

S-383

The discharge rating curve used to calculate discharges at the headwater of the DWSA are presented in **Tables K-2** and **K-3**. **Table K-2** presents the wet season curve while **Table K-3** presents the dry season curve.

Table K-2. Discharge Rating Curve for the S-383 Pump Station during the Wet Season

Elevation at DWSA Headwater (feet NGVD)	DWSA Discharge (Q) (cfs)
13.0	0
14.0	6
15.0	14
16.0	23
17.0	33
18.0	35
19.0	35
20.0	35
21.0	35
22.0	35
23.0	35
24.0	35
25.0	35
26.0	35
27.0	35
28.0	35
29.0	35

Table K-3. Discharge Rating Curve for the S-383 Pump Station during the Dry Season

Elevation at DWSA Headwater (feet NGVD)	DWSA Discharge (Q) (cfs)
13.0	0
14.0	4
15.0	9
16.0	14
17.0	21
18.0	28
19.0	35
20.0	35
21.0	35
22.0	35
23.0	35
24.0	35
25.0	35
26.0	35
27.0	35
28.0	35
29.0	35

The following operating guidelines should be used for the S-383 outflow structure. Based on the difficulty of accessing S-383, gate or pump operational changes should not be made more than once a week.

S-383 Operating Guidelines for the Wet Season

The wet season begins in June and ends in November. The operating guidelines for S-383 during the wet season are as follows:

1. If the water level in the DWSA increases to 14.0 feet NGVD, discharge 6 cfs of water to the treatment cell.
2. If the water level in the DWSA increases to 15.0 feet NGVD, discharge 14 cfs of water to the treatment cell.
3. If the water level in the DWSA increases to 16.0 feet NGVD, discharge 23 cfs of water to the treatment cell.
4. If the water level in the DWSA increases to 17.0 feet NGVD, discharge 33 cfs of water to the treatment cell.
5. If the water level in the DWSA increases to 18.0 feet NGVD or over, discharge 35 cfs of water to the treatment cell.

S-383 Operating Guidelines for the Dry Season

The dry season begins in December and ends in May. The operating guidelines for S-383 during the dry season are as follows:

1. If the water level in the DWSA increases to 14.0 feet NGVD, discharge 4 cfs of water to the treatment cell.
2. If the water level in the DWSA increases to 15.0 feet NGVD, discharge 9 cfs of water to the treatment cell.
3. If the water level in the DWSA increases to 16.0 feet NGVD, discharge 14 cfs of water to the treatment cell.
4. If the water level in the DWSA increases to 17.0 feet NGVD, discharge 21 cfs of water to the treatment cell.
5. If the water level in the DWSA increases to 18.0 feet NGVD, discharge 28 cfs of water to the treatment cell.
6. If the water level in the DWSA increases to 19.0 feet NGVD, discharge 35 cfs of water to the treatment cell.

S-384 Operating Guidelines

If water is available, the S-384 culvert should be operated to maintain the equivalent of 3 feet of water storage in the treatment cell. The goal is to make water available for releases for environmental enhancement. The operation of this structure is based on the optimum water storage capacity of 3 feet shown by a model developed by the SFWMD. MORE INFO ON MODEL.

Spillway Operating Guidelines

The spillway surcharge elevation is 31.6 feet NGVD with a discharge capacity of about 1,440 cfs. If the spillway overflows, S-383 and S-384 shall be closed to avoid worsening existing conditions.

OTHER EFFECTS OF THE WATER CONTROL PLAN

Recreation. The water management operations do not include those specifically designed for the benefit of recreational activities within the Ten Mile Creek Project area.

Water Quality. The intent of the Ten Mile Creek DWSA project is to attenuate stormwater flows into the North Fork of the St. Lucie River. These flows, which originate in the Ten Mile Creek basin, are to be captured and stored in the DWSA and subsequently pumped into a treatment pond before release back into the creek. The resulting hydrodynamic, physical, and biological treatment is expected to ultimately result in the reduction of undesirable freshwater loads being delivered to the St. Lucie Estuary. CITE

THE ENVIRONMENTAL ASSESSMENT FOR THE "TEN MILE CREEK WATER PRESERVE AREA CRITICAL PROJECT" (CALL OUT).

Fish and Wildlife in the DWSA. The fish and wildlife resources in the footprint of the DWSA will change from citrus grove fauna to an open water system. Prey fish species such as centarchids (sunfish) and mosquito fish will quickly colonize the DWSA. As the DWSA levels decrease these fish can act as forage for wading birds, raccoons and other small mammals, and other organisms. The DWSA will also support reptiles and amphibians including salamanders and turtles. CITE THE ENVIRONMENTAL ASSESSMENT FOR THE "TEN MILE CREEK WATER PRESERVE AREA CRITICAL PROJECT".

Fish and Wildlife in the Treatment Cell. The treatment cell fauna will stay the same with possibly the addition of a number of organisms suited for shallow water conditions (3 to 4 feet). Since these conditions currently exist in the wetlands of the treatment cell, increased numbers will occur because of a potentially larger amount of this type of habitat.

Fish and Wildlife in the St. Lucie Estuary and the Indian River Lagoon. The St. Lucie Estuary, which is downstream of the project, will help restore the St. Lucie Estuary to a healthy and sustainable ecosystem. With a decrease in the size and frequency of freshwater pulses, the waters of the estuary should become clearer and more saline. The estuary is expected to then be able to support shoal grass and oysters and other typical elements of the estuarine fauna. In order to fully restore the Indian River Lagoon, however, the proposed project will have to act as one part of the improvements recommended in the *Indian River Lagoon Feasibility Study* (CITATION), in order to fully return the St. Lucie Estuary to a healthy ecosystem and ultimately maximize estuarine benefits. Once the St. Lucie Estuary is restored, the Indian River Lagoon system in that area should yield secondary benefits to the nearby seagrass.

Water Supply. Water supply will not be affected by the water control plan. Water pumped into the DWSA would be storm water normally lost to tide. Local ground water recharge would be expected to increase, possibly offsetting some effects of agricultural withdrawals on adjoining lands.

Prestorm Canal Drawdown. When heavy rainfall is anticipated in the Ten Mile Creek basin from tropical storms, hurricanes, and other extreme rainfall events, water levels will be drawn down as much as practicable in order to allow for the maximum amount of canal and ground water storage.

Seepage Control. If the criteria for pumping has been met, any seepage lost through the levee around the impoundment will be recaptured with pump operations.